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Floristic composition and structure of two stands of *Senna reticulata* differing in age

by

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Abstract

Senna reticulata ('matapasto') is a woody pioneer which colonizes Amazonian whitewater floodplains. In open areas, especially those which have suffered a strong anthropogenic impact, *Senna reticulata* dominates over other woody and herbaceous species forming large, apparently monospecific stands. In the present study, stands of *Senna reticulata* which were two and six years old were inventoried in order to describe differences of species dominance and physiognomy. *Senna reticulata* dominated in the first years after establishment, representing 86.4 % of all individuals in the two year old plots and forming the canopy at 4-5 m height. In the six year old plots, *Senna reticulata* had only 28.4 % of all individuals, and the canopy at 7-8 m height was formed by 12 species. The vitality of *Senna reticulata* was low in the six year old stands. The trees had higher stems but very small crowns with few leaves, enabling the co-occurring slow growing, long-lived species to take over dominance. This study shows that *Senna reticulata*, although considered a noxious woody weed by the local people, has a restricted period of dominance and represents the initial phase of a successional sequence that leads to a diversity comparable to that of areas which have not suffered anthropogenic impact.

Keywords: **Floodplain, várzea, succession, *Senna reticulata*, Amazonia, Neotropics.**

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Introduction

Senna reticulata (WILLD.) IRWIN & BARN. (Caesalpiniaceae) (synonyms *Cassia alata, Cassia reticulata*; LORENZI 1991) is a typical pioneer tree of maximum 12 m height. It colonizes open areas in nutrient rich Amazonian whitewater floodplains, called seasonal várzea (PRANCE 1979). These environments are characterized by periodical floodings which can last up to seven months and oscillate by 10 m (JUNK 1989). *Senna reticulata* occurs throughout Amazonia along the whitewater rivers (DUCKE 1949; DE MENEZES 1978; KALLIOLA et al. 1991), but is restricted to the upper levels of the inundation gradient (maximum down to ca. 23 m asl near Manaus) because seedlings and mature trees do not tolerate complete flooding.

In the first years after establishment, this species forms large monospecific stands, especially on abandoned pastures or other areas which suffered a strong anthropogenic impact and high 'nutrient input' (Fig. 1). Its local name 'matapasto' ('pasture killer') is related to its fast growth and the capacity to outshade other species. For this reason, *Senna reticulata* is not liked by the local farmers. They usually cut and burn it shortly before the beginning of inundation in order to eliminate it. Thus, intact stands of higher ages than 1-2 years are difficult to find.

Senna reticulata trees do not occur inside mature forests. The species is seldom mentioned in vegetation inventories (e.g. in WORBES et al. 1992), probably because these are generally carried out in little to not disturbed areas. Dense *Senna reticulata* stands can be found directly adjacent to sites at which inventories were performed. If disturbed areas were to be analysed, then the dominating pioneer species would be *Salix humboltiana, Cecropia latiloba* or *Cecropia membranacea* (SALO et al. 1986; LAMOTTE 1992; WORBES et al. 1992) which occur parallel to the *Senna reticulata* stands, often on longer flooded and less disturbed sites. These pioneer species seldom occur together (PAROLIN et al. 1995; PAROLIN, in press).

In the present study, vegetation inventories were performed in stands of differing ages dominated by *Senna reticulata* (Fig. 2, 3). The sites were deliberately chosen in altered environments where *Senna reticulata* was obviously the dominant species. The aim of this paper is to describe changes in dominance of *Senna reticulata* with increasing stand age.

Methods

The study areas were located in the floodplains of the Amazon (Solimões) River, near the confluence with the Rio Negro, in the vicinity of Manaus, Brazil (Fig. 4). According to the number of annual increment rings measured in the wood of several trees of different species, and according to the specifications of the local farmers who cut and burn the stands of *Senna reticulata* regularly, the age of the vegetation stands was identified as: 2 years age (5 plots: n° 1, 2, 3, c, d) and 6 years age (2 plots: n° a, b). Three plots (n° 1, 2, 3) were located on the Fazenda Lira (Costa do Catalão) and four plots (n° a, b, c, d) were located on the Fazenda Pec (Terra Nova/Ilha do Careiro).

Species were identified in the field with the help of José F. Ramos from INPA (Instituto Nacional de Pesquisas da Amazônia, Manaus) and Leandro V. Ferreira (INPA/Smithsonian Institution, Manaus). Identifications were checked in the herbarium of the INPA.

All woody species (including lianas) with dbh > 1 cm or a height > 1 m were inventoried in the seven plots of 25 x 25 m each. Dead trees were inventoried separately. For each tree, species, diameter at breast height (dbh), tree height, crown length and crown width were recorded, and different parameters were calculated:

abundance	total number of individuals per species in the sampled plots
absolute density per ha	total number of individuals per species, calculated to 1 ha
relative density	relation between total number of individuals per species and total number of individuals of all species in all plots
relative frequency	percentage of plots in which the species occurs
absolute dominance	stem cross section (m^2) per ha, calculated by the dbh of the species
relative dominance	percentage of the species' dominance at total m^2 of all species per ha
IVI	species importance value index = relative density + relative frequency + relative dominance

Mann-Whitney statistical analysis was used to test the differences of tree height, evenness and species diversity between the two and six year old plots.

Results and discussion

Floristic composition

2246 trees were inventoried, 1549 in the two year old plots and 697 in the six year old plots. In total, 32 woody species from 19 families were determined in the two year old plots. 34 woody species from 22 families were determined in the six year old plots. 22 species were common to the plots of both ages, while 10 species were restricted to the two year old plots and 12 to the six year old plots (Tab. 1).

The number of species per plot was twice as high in the six year old plots than in the two year old plots (Tab. 2). The mean number of trees was similar in both plots, and the number of dead trees, which were not included in the calculations, was twice as high in the two year old plots.

Species composition in the two year old plots (Tab. 3) and in the six year old plots (Tab. 4) differed with respect to density, frequency, dominance and importance value index (IVI) of the species. In the two year old plots, *Senna reticulata* prevailed with a relative dominance of 93.7 %, and an IVI of 280.2. *Triplaris surinamensis* and *Vitex cymosa*, which follow *Senna reticulata* in the ranking, had much lower IVI (81.2 and 62.3, respectively). In the six year old plots, *Senna reticulata* was still the most frequent species with a relative dominance of 52.9 % and an IVI of 181.3. In these plots, the difference to the next species in the ranking of IVI was much smaller (151.9 in *Platymiscium ulei* and 115.5 in *Ocotea amara*).

Forest structure

Most trees had diameters at breast height (dbh) between 1 and 6.9 cm in both the two and six year old plots (Fig. 5), but mean dbh in the two year ald plots was lower than in the six year old plots (Tab. 2). The trees in the six year old plots had a wider range of diameters, with a maximum of 32.0 cm (*Cecropia membranacea*), whereas the trees in the two year old plots had a maximum of 14.6 cm (*Vitex cymosa*).

Maximum height was 5.5 m (*Senna reticulata*) in the two year old plots, and 12 m (*Platymiscium ulei*) in the six year old plots. Mean tree height in the two year old plots was significantly lower than in the six year old plots (Tab. 2; U = 0.5, p = 0.034). The

canopy in the two year old plots was between 4-4.9 m and was formed mainly by *Senna reticulata*. Mean crown diameter in the two year old plots was almost half that of the trees in the six year old plots (Tab. 2). In the six year old plots, most crowns closed at 7-8 m, but the distribution of height classes did not show a well defined canopy (Fig. 6). *Senna reticulata* and *Platymiscium ulei* dominated at 7-8 m and formed the main canopy.

Senna reticulata in stands of two and six years of age

The presence and dominance of *Senna reticulata* showed clear differences in the plots of two and six years of age. Mean number of individuals of *Senna reticulata* was almost three times as high in the younger plots (Tab. 5), which is documented also by the absolute and relative dominance and IVI of this species in the plots.

Species diversity was significantly higher in the six year old plots, compared to the two year old plots ($U = 15.0$, $p = 0.024$). The dominance of *Senna reticulata* decreased with stand age. The mean density of *Senna reticulata* decreased from 86.4 % to 28.4 %. The total number of species per plot increased from 13 to 27 (Tab. 2), indicating that other species gained more importance.

If *Senna reticulata* is excluded from the calculations, in the two year old plots there was an average of 3.1 individuals per species (Tab. 5), compared to 9.2 in six year old plots. This is emphasized by the evenness value of abundance (Tab. 2, calculated according to KEEL & PRANCE 1979), which was significantly higher in the older plots ($U = 0.00$, $p = 0.024$). The higher evenness indicates that more species have few individuals in older plots.

In the two year old plots, 70 % of the *Senna reticulata* trees had diameters below 5 cm, compared to 46 % in the six year old plots (Fig. 7). Maximum dbh was 8.6 cm in the two year old plots, and 13 cm in the six year old plots. The canopy in the two year old plots was formed exclusively by *Senna reticulata* trees at a height between 4 and 6 m (Fig. 8). In the six year old plots, most *Senna reticulata* trees were 7-9 m high. Maximum height was 5.5 m in the two year old plots, and 10 m in the six year old plots.

The relation between dbh and height in the *Senna reticulata* trees differed in the plots of different age (Fig. 9). In the two year old plots, also the trees with very low or very high dbh reached heights of 4 m, while in the six year old plots the low trees had small dbh, and the high trees had high dbh.

Comparison with other floodplain forests

Species diversity was lower in the stands of both ages of this study than in mature stands of Amazonian floodplain forests (PIRES & KOURY 1959; TAKEUCHI 1962; AYRES 1993; KLINGE et al. 1995). Evenness was 0.23 and 0.58 in the analysed two and six year old stands of *Senna reticulata*, respectively, compared to 0.75 in a black-water (igapó) forest (KEEL & PRANCE 1979). The number of individuals was higher and the number of species was lower in the present study than in older forests. Many species mentioned for mature forests (WORBES 1983, 1986; KLINGE et al. 1995) occurred also in the present study, although in the young plots these species were represented only by small individuals with yery low IVI.

Dbh and height were lower in the two and six year old *Senna reticulata* stands than in mature forests. In a mature várzea forest on the Ilha de Marchantaria, 10 km from the

sites analysed in this study, four crown layers could be found, the highest at 23-28 m, the lowest at < 10 m (WORBES 1983). At another site on the same island, the highest trees were 26 m high, and mean tree height was 5 to 10 m (KLINGE et al. 1995). In this forest, the dbh of 50 % of the trees was above 19 cm. The same was found in a mature várzea forest near Tefé (AYRES 1993). In a mixedwater inundation forest at Lago Janauari, 20 km from the study sites, the dbh of most species was below 20 cm, but exceeded 100 cm in some species (AMARAL et al. 1997).

Conclusions

The results of this study show that the dominance of *Senna reticulata* was very high only in the first two years after establishment. In the two year old plots, *Senna reticulata* had 86.4 % of all individuals and formed the canopy at 4-5 m height. In the six year old plots, *Senna reticulata* had only 28.4 % of all individuals, and the canopy at 7-8 m height was formed by 12 species. At this stage, *Senna reticulata* still had the highest relative dominance and IVI, but the tree crowns were very small and had only few leaves. This enabled the co-occurring slow growing, long-lived species to take over dominance as is typical for successional sequences. In young várzea stands in Central Amazonia, rapidly growing pioneer species dominate (*Salix humboldtiana, Cecropia latiloba*; LAMOTTE 1992; WORBES et al. 1992), and are replaced by slow growing, long-lived species in the following years (WORBES et al. 1992). This shift is often linked to changes of light incidence below the canopy, a relevant factor especially in the case of *Senna reticulata* which forms an extremely dense canopy in the first years and only later, after shedding the majority of its leaves, yields sufficient light to smaller plants.

Vast areas along the Amazon river are dominated by *Senna reticulata* as a consequence of human activities. Forest clearcut and subsequent cattle and water buffalo raising on pastures (OHLY 1985) lead to high light incidence and nutrient input into the soils which favour the establishment of *Senna reticulata* as the main pioneer species. Although considered a noxious woody weed by the local people (DE MENEZES 1978), *Senna reticulata* has a restricted period of dominance and plays an important role in the initial phase of a successional sequence that leads to a diversity which is comparable to that of areas which did not suffer anthropogenic impact.

Resumo

Senna reticulata ("matapasto") é uma árvore pioneira que coloniza áreas inundáveis de água branca na Amazônia. Em áreas abertas, especialmente aquelas que sofrem alto impacto antropogênico, a espécie domina sobre as outras espécies lenhosas e herbáceas, formando agrupamentos aparentemente monoespecíficos. No presente estudo, grupos de *Senna reticulata* de dois e seis anos foram inventariados, a fim de se descrever as diferenças de dominância e fisionomia das espécies. *Senna reticulata* dominou nos primeiros anos após o estabelecimento, representando cerca de 86,4 % dos indivíduos nos plotes de dois anos, cujo dossel se encontrava a 4-5 m de altura. Nos plotes de seis anos, a porcentagem de *Senna reticulata* reduziu-se para 28,4 % de todos os indivíduos, compondo um dossel de 7-8 m de altura, formado por 12 espécies. Nestes, a vitalidade de *Senna reticulata* foi menor. Porém, as árvores eram mais altas, tendo copas pequenas e reduzidas à poucas folhas permitindo assim a dominância de outras espécies de cresci-

mento mais lento, mas de longa existência. Este estudo mostra que mesmo sendo considerada uma "planta daninha" pela população local, *Senna reticulata* representa a fase inicial de uma sucessão que leva à formação de uma floresta com diversidade comparável aquelas sem influência antropogênica.

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Table 1: Species occurring in 2-year old, 6-year old and in both 2- and 6-year old plots (each 25 x 25 m) on Fazenda Lira (Costa do Catalão) and Fazenda Pec (Terra Nova/Ilha do Careiro).

Plot age 2	**Plot age 6**	**Both**
1 *Bauhinia* sp.	1 *Casearia aculeata*	1 *Astrocaryum jauari*
2 *Buchenavia oxycarpa*	2 *Eugenia* sp.	2 *Arrabidaea* sp.
3 *Cassia leiandra*	3 *Fagara compactum*	3 *Campsiandra angustifolia*
4 *Crateva benthami*	4 *Ilex inundata*	4 *Cecropia latiloba*
5 *Ficus* sp.	5 *Ouratea* sp.	5 *Cecropia membranacea*
6 *Macrolobium acaciifolium*	6 *Pouteria glomerata*	6 *Entada polyphylla*
7 *Piranhea trifoliata*	7 *Pseudoxandra polyphleba*	7 *Erythrina fusca*
8 *Tabebuia barbata*	8 *Psidium acutangulum*	8 *Genipa americana*
9 *Vitex cymosa*	9 *Salacia* sp.	9 *Inga punctata*
10 *Zygia inaequale*	10 *Schizolobium* sp.	10 *Inga* sp.
	11 *Spondias lutea*	11 *Laetia corymbulosa*
	12 *Zanthoxylum* sp.	12 *Ocotea amara*
		13 *Ormosia* sp.
		14 *Platymiscium ulei*
		15 *Pseudobombax munguba*
		16 *Sapium glandulosum*
		17 *Senna reticulata*
		18 *Solanum critino*
		19 *Triplaris surinamensis*
		20 *Leguminosae undet.*
		21 *Xylosoma intermedium*
		22 *Zanthoxylum compactum*

Table 2: Comparison of 2-year and 6-year old plots of *Senna reticulata*: floristic composition and forest structure (average and standard deviation).

plot age	2 years	6 years
mean number of species per plot (625 m^2)	13 ± 7	27 ± 4
mean number of trees per plot	310 ± 130	349 ± 52
dead trees per plot (%)	10.9	5.4
evenness	0.23 ± 0.06	0.58 ± 0.11
mean dbh (cm)	3.5 ± 2	5.2 ± 4
mean tree height (m)	3.5 ± 1	5.0 ± 2
mean tree height (m) of trees with dbh > 5 cm	4.5 ± 0.6	7.6 ± 2
mean crown area (m^2)	2.5	4.1

Table 5: Comparison of *Senna reticulata* in 2-year and 6-year old plots.

plot age	2 years	6 years
absolute dominance of *Senna reticulata* (in m^2/ha)	1.3	0.2
relative dominance of *Senna reticulata*	93.7	52.9
IVI of *Senna reticulata*	280.2	181.3
mean number of *Senna reticulata* individuals (per plot)	268 ± 107	99 ± 7
mean number of individuals per species per plot (*Senna reticulata* excluded)	3.1	9.2

Table 3: Species composition in 2-year old plots (each 25 x 25 m) on Fazenda Lira (Costa do Catalão) and Fazenda Pec (Terra Nova/Ilha do Careiro), with abundance, relative and absolute density, frequency, mean dbh of the species, dominance and IVI; (for explanations and calculations, see text). *liana.

	species	family	local name	plot 1	plot 2	plot 3	plot c	plot d	abundance	relative density	absolute density per ha	relative frequency	mean dbh [cm]	absolute dominance [in m^2/ha]	relative dominance	IVI
1	*Senna reticulata*	Caesalpiniaceae	Matapasto	333	256	406	217	127	1339	86,4	2678	100	5	1,339	93,7	280,2
2	*Triplaris surinamensis*	Polygonaceae	Tachi	1	6	5	1	0	13	0,8	26	80	2	0,0052	0,4	81,2
3	*Vitex cymosa*	Verbenaceae	Taruma	3	8	11	0	0	22	1,4	44	60	3	0,0132	0,9	62,3
4	*Zanthoxylum compactum*	Rutaceae	Limorana	8	2	19	0	0	29	1,9	58	60	1	0,0058	0,4	62,3
5	*Crateva benthami*	Capparidaceae	Catoré	10	5	7	0	0	22	1,4	44	60	2	0,0088	0,6	62,0
6	*Ocotea amara*	Lauraceae	Louro	3	3	4	3	1	14	0,9	28	60	1	0,0028	0,2	61,1
7	*Cecropia latiloba*	Cecropiaceae	Imbauba branca	0	1	0	2	1	4	0,3	8	60	1,5	0,0012	0,1	60,3
8	*Genipa americana*	Rubiaceae	Genipapo	0	3	4	0	0	7	0,5	14	40	8	0,0112	0,8	41,2
9	*Tabebuia barbata*	Bignoniaceae	Capitari	0	2	11	0	0	13	0,8	26	40	2	0,0052	0,4	41,2
10	*Platymiscium ulei*	Papilionaceae	Macacauba	0	0	0	5	1	6	0,4	12	40	7	0,0084	0,6	41,0
11	*Pseudobombax munguba*	Bombacaceae	Munguba	9	1	1	0	0	11	0,7	22	40	1,5	0,0033	0,2	40,9
12	*Astrocaryum jauari*	Arecaceae	Jauari	0	3	5	0	0	8	0,5	16	40	2	0,0032	0,2	40,7
13	*Ficus anthelmintica?*	Moraceae	Caxinguba	0	3	4	0	0	7	0,5	14	40	2	0,0028	0,2	40,6
14	*Cecropia membranacea*	Cecropiaceae	Imbauba amarela	0	0	0	1	3	4	0,3	8	40	6	0,0048	0,3	40,6
15	*Solanum critino*	Solanaceae	Jurubeba	0	0	0	1	5	6	0,4	12	40	2	0,0024	0,2	40,6
16	*Erythrina fusca*	Papilionaceae	Mulungú	0	0	0	2	3	5	0,3	10	40	2	0,002	0,1	40,5
17	*Macrolobium acacifolium*	Caesalpiniaceae	Arapari	1	3	0	0	0	4	0,3	8	40	1	0,0008	0,1	40,3
18	*Campsiandra angustifolia*	Caesalpiniaceae	Acapurana	0	1	3	0	0	4	0,3	8	40	1	0,0008	0,1	40,3
19	*Cassia leiandra*	Caesalpiniaceae	Marimarí	0	2	1	0	0	3	0,2	6	40	1	0,0006	0,0	40,2
20	*undet. Legum.*	Leguminosae	Agudaoeira	0	1	2	0	0	3	0,2	6	40	0,7	0,00042	0,0	40,2
21	*Inga punctata*	Mimosaceae	Ingá	0	0	1	1	0	2	0,1	4	40	2	0,0008	0,1	40,2
22	*Entata polyphylla*	Mimosaceae	Paricarana	0	1	1	0	0	2	0,1	4	40	1	0,0004	0,0	40,2
23	*Xylosoma intermedium*	Flacourtiaceae	Limorana 3	0	7	0	0	0	7	0,5	14	20	2	0,0028	0,2	20,6
24	*Bauhinia sp.*	Caesalpiniaceae	Pé de vaca *	0	5	0	0	0	5	0,3	10	20	0,5	0,0005	0,0	20,4
25	*Buchenavia oxycarpa*	Combretaceae	Tanibuco	0	0	2	0	0	2	0,1	4	20	1	0,0004	0,0	20,2
26	*Ormosia sp.*	Fabaceae	Buiussu	0	0	0	1	0	1	0,1	2	20	2	0,0004	0,0	20,1
27	*Laetia corymbulosa*	Flacourtiaceae	Sardinheira	0	0	1	0	0	1	0,1	2	20	2	0,0004	0,0	20,1
28	*Inga sp. 1*	Mimosaceae	Ingá-açu	0	0	1	0	0	1	0,1	2	20	1,5	0,0003	0,0	20,1
29	*Sapium glandulosum*	Euphorbiaceae	Tapuru	0	0	0	1	0	1	0,1	2	20	1	0,0002	0,0	20,1
30	*Arrabidaea sp.*	Bignoniaceae	Unha de cigana *	0	1	0	0	0	1	0,1	2	20	1	0,0002	0,0	20,1
31	*Piranhea trifoliata*	Euphorbiaceae	Piranheira	0	1	0	0	0	1	0,1	2	20	1	0,0002	0,0	20,1
32	*Zygia inaequale*	Mimosaceae		0	1	0	0	0	1	0,1	2	20	1	0,0002	0,0	20,1
	TOTAL			368	316	489	235	141	1549	100,0	3098			1,43	100,0	1480,0

Table 4: Species composition in 6-year old plots (each 25 x 25 m) on Fazenda Pec (Terra Nova/Ilha do Careiro); with abundance, relative and absolute density, frequency, mean dbh of the species, dominance and IVI (for explanations and calculations, see text). *liana.

	species	family	local name	plot a	plot b	abundance	relative density	absolute density per ha	relative frequency	mean dbh [cm]	absolute dominance [in m²/ha]	relative dominance	IVI
1	*Senna reticulata*	Caesalpiniaceae	Matapasto	94	104	198	28,4	396	100	5	0,198	52,9	181,3
2	*Platymiscium ulei*	Papilionaceae	Macacaúba	82	150	232	33,3	464	100	1,5	0,0696	18,6	151,9
3	*Ocotea amara*	Lauraceae	Louro	29	33	62	8,9	124	100	2	0,0248	6,6	115,5
4	*Genipa americana*	Rubiaceae	Genipapo	2	11	13	1,9	26	100	7	0,0182	4,9	106,7
5	*Astrocaryum jauari*	Arecaceae	Jauarí	7	3	10	1,4	20	100	8	0,016	4,3	105,7
6	*Erythrina fusca*	Papilionaceae	Mulungú	18	8	26	3,7	52	100	1	0,0052	1,4	105,1
7	*Ormosia sp.*	Fabaceae	Buiussu	1	15	16	2,3	32	100	2	0,0064	1,7	104,0
8	*Cecropia latiloba*	Cecropiaceae	Imbauba branca	10	4	14	2,0	28	100	2	0,0056	1,5	103,5
9	*Zanthoxylum compactum*	Rutaceae	Limorana	7	9	16	2,3	32	100	1	0,0032	0,9	103,2
10	*Ouratea sp.*	Ochnaceae	Canicero	6	6	12	1,7	24	100	2	0,0048	1,3	103,0
11	*Sapium glandulosum*	Euphorbiaceae	Tapuru	3	8	11	1,6	22	100	1	0,0022	0,6	102,2
12	*Inga punctata*	Mimosaceae	Ingá	4	4	8	1,1	16	100	2	0,0032	0,9	102,0
13	*Campsiandra angustifolia*	Caesalpiniaceae	Acapurana	4	5	9	1,3	18	100	1	0,0018	0,5	101,8
14	*Arrabidaea sp.*	Bignoniaceae	Unha de cigana *	4	4	8	1,1	16	100	1	0,0016	0,4	101,6
15	*Salacia sp.*	Hippocrataceae	Cipó *	4	3	7	1,0	14	100	1	0,0014	0,4	101,4
16	*Triplaris surinamensis*	Polygonaceae	Tachí	1	4	5	0,7	10	100	2	0,002	0,5	101,3
17	*Cecropia membranacea*	Cecropiaceae	Imbauba amarela	3	3	6	0,9	12	100	1	0,0012	0,3	101,2
18	*Zanthoxylum sp.*	Rutaceae	Limorana 2	2	3	5	0,7	10	100	1	0,001	0,3	101,0
19	*Solanum critino*	Solanaceae	Jurubeba	4	1	5	0,7	10	100	1	0,001	0,3	101,0
20	*Pseudobombax munguba*	Bombacaceae	Munguba	2	1	3	0,4	6	100	1,5	0,0009	0,2	100,7
21	*Pouteria glomerata*	Sapotaceae	Abiurana	6	0	6	0,9	12	50	1	0,0012	0,3	51,2
22	*undet. Legum.*	Leguminosae	Agudaoeira	5	0	5	0,7	10	50	0,7	0,0007	0,2	50,9
23	*Laetia corymbulosa*	Flacourtiaceae	Sardinheira	4	0	4	0,6	8	50	1	0,0008	0,2	50,8
24	*Casearia aculeata*	Flacourtiaceae	Patajuba	2	0	2	0,3	4	50	2	0,0008	0,2	50,5
25	*Schizolobium sp.*	Caesalpiniaceae	Paricarana 2	2	0	2	0,3	4	50	1	0,0004	0,1	50,4
26	*Psidium acutangulum*	Myrtaceae	Goiaba araça	2	0	2	0,3	4	50	1	0,0004	0,1	50,4
27	*Pseudoxandra polyphleba*	Annonaceae	Envira	0	2	2	0,3	4	50	1	0,0004	0,1	50,4
28	*Ilex inundata*	Aquifoliaceae	Turima	0	2	2	0,3	4	50	1	0,0004	0,1	50,4
29	*Eugenia sp.*	Myrtaceae	Goiabarana	1	0	1	0,1	2	50	1,5	0,0003	0,1	50,2
30	*Fagara compactum*	Rutaceae	Tamaqueira	0	1	1	0,1	2	50	1	0,0002	0,1	50,2
31	*Entata polyphylla*	Mimosaceae	Paricarana	1	0	1	0,1	2	50	1	0,0002	0,1	50,2
32	*Spondias lutea*	Anacardiaceae	Taperebá	1	0	1	0,1	2	50	1	0,0002	0,1	50,2
33	*Xylosoma intermedium*	Flacourtiaceae	Limorana 3	1	0	1	0,1	2	50	1	0,0002	0,1	50,2
34	*Inga sp.*	Mimosaceae	Ingá-açu	0	1	1	0,1	2	50	0,5	0,0001	0,0	50,2
	TOTAL			312	385	697	100,0	1394			0,3744	100,0	2900,0

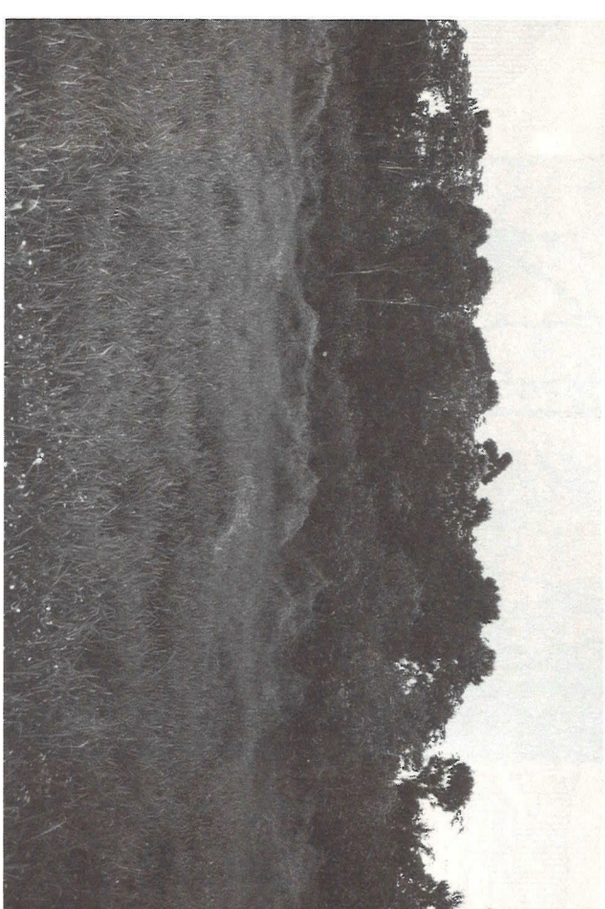

Fig. 1:
Two year old stand of *Senna reticulata* ("Matapasto", Caesalpiniaceae) on Fazenda Pec/Ilha do Careiro, with pasture in front and rests of mature forest behind.

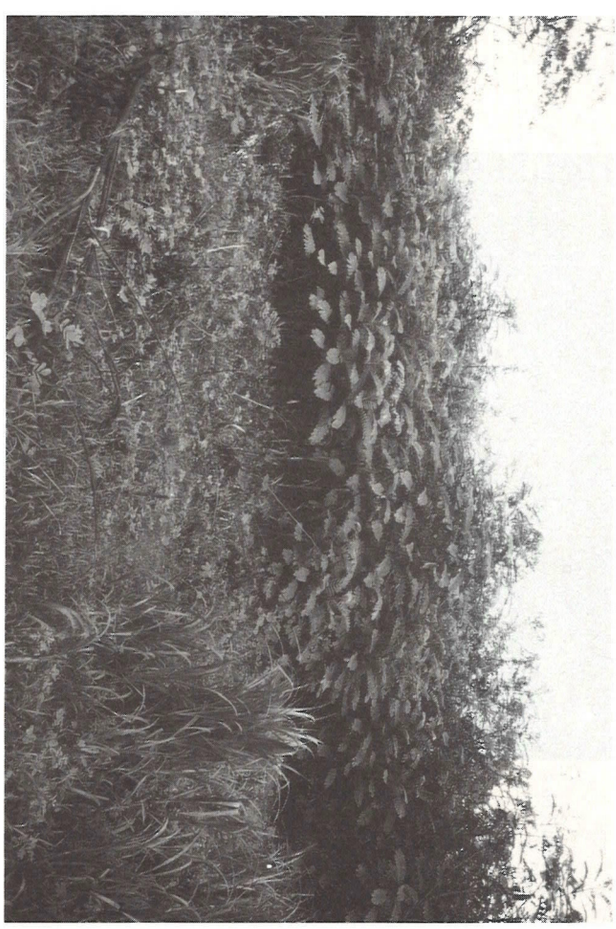

Fig. 2:
Two year old stand of *Senna reticulata* on Fazenda Lira/Costa do Catalão.

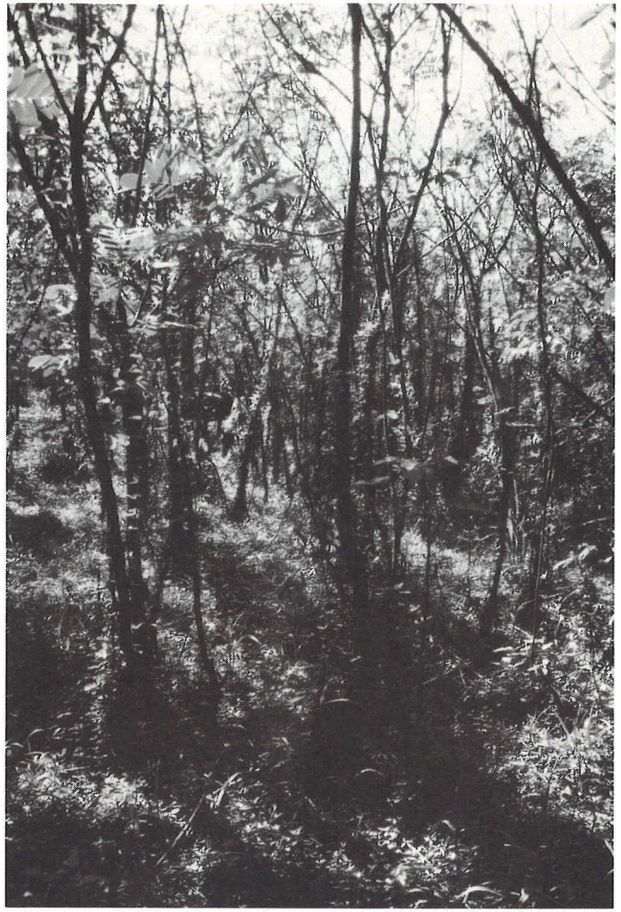

Fig. 3:
Six year old stand of *Senna reticulata* on Fazenda Pec/Ilha do Careiro.

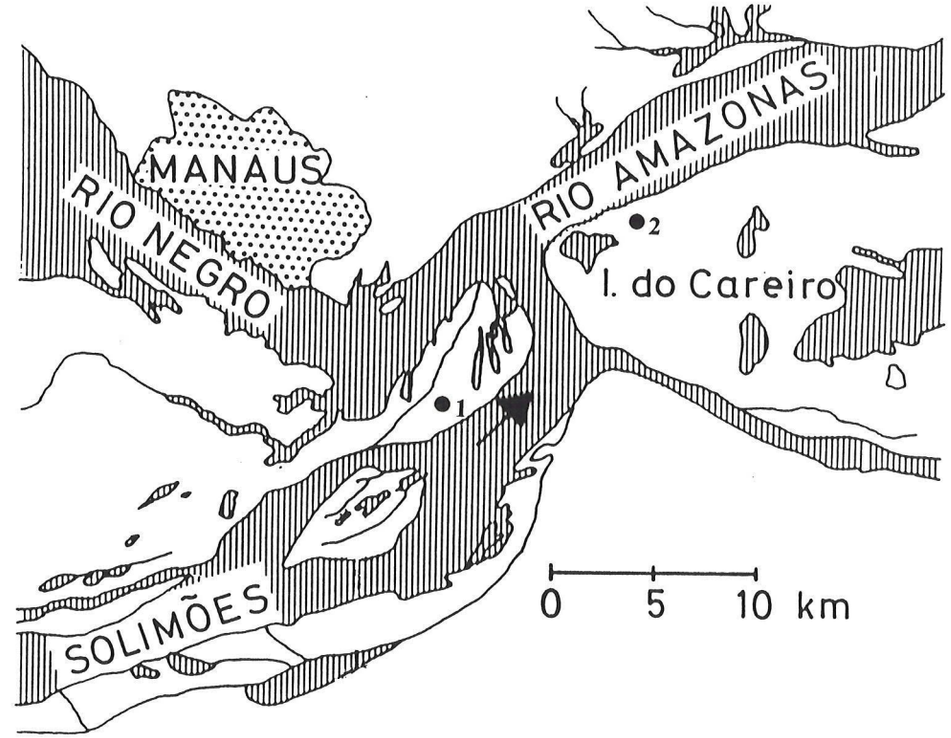

Fig. 4:
Location of the study areas: Fazenda Lira on Costa do Catalão (1) and Fazenda Pec on Ilha do Careiro (2).

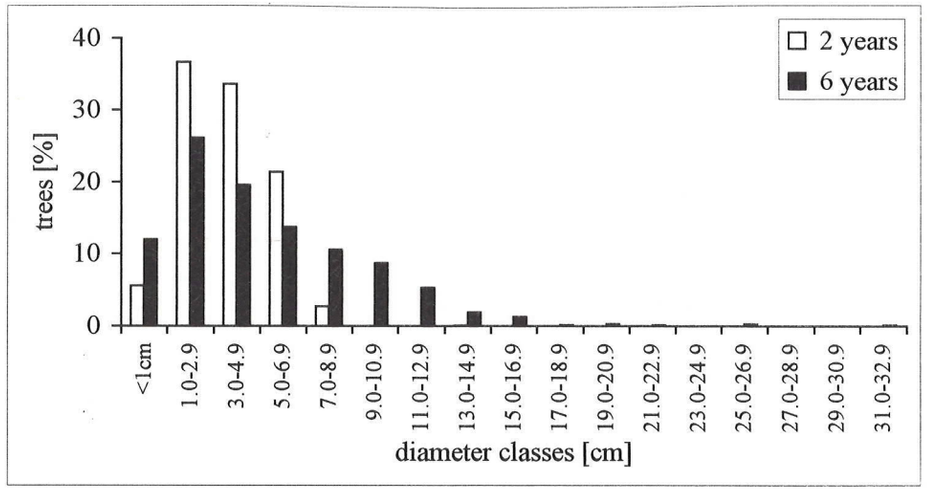

Fig. 5:
Diameter classes of all trees inventoried in *Senna reticulata* stands of 2 and 6 years age. n = 1567 trees in plots of 2 years, n = 701 trees in plots of 6 years.

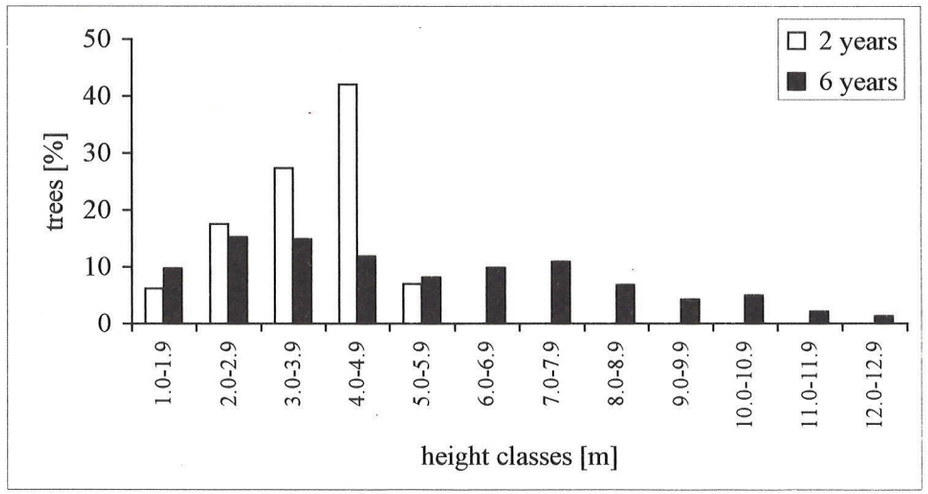

Fig. 6:
Height classes of all trees inventoried in *Senna reticulata* stands of 2 and 6 years age. n = 1355 trees in plots of 2 years, n = 701 trees in plots of 6 years.

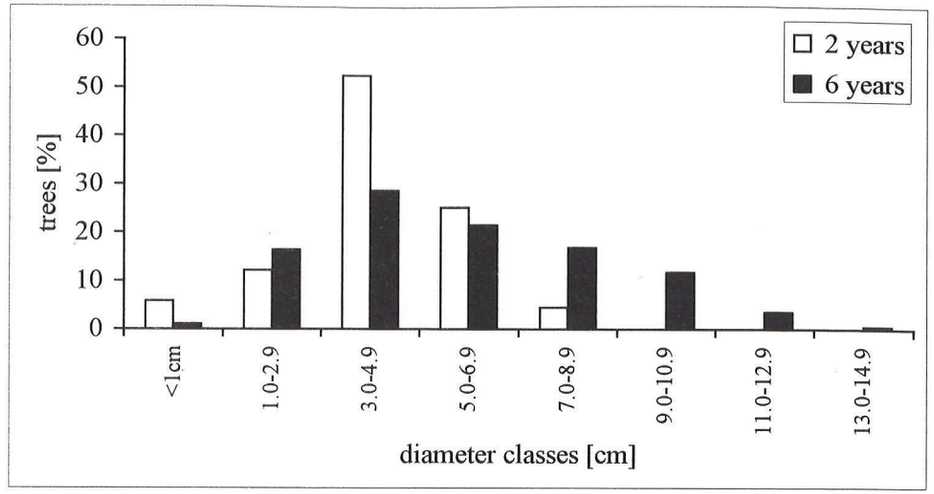

Fig. 7:
Diameter classes of *Senna reticulata* trees inventoried in stands of 2 and 6 years age. n = 954 trees in plots of 2 years, n = 196 trees in plots of 6 years.

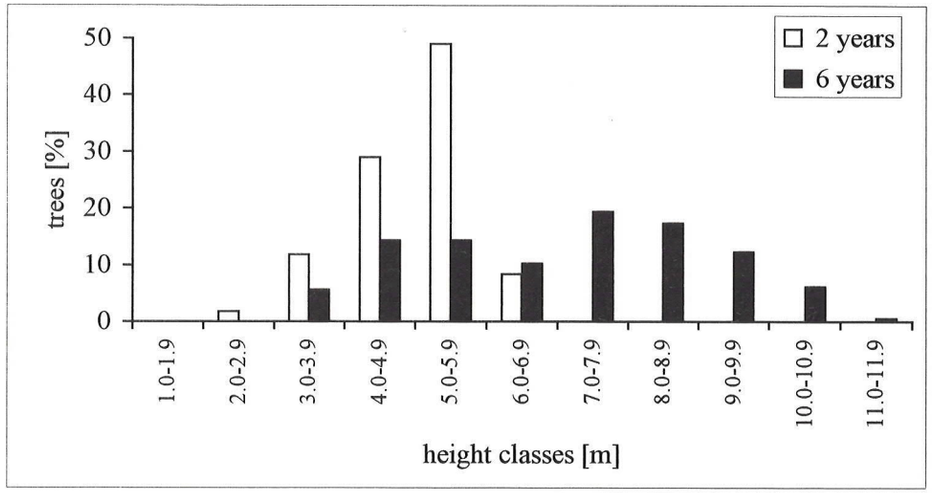

Fig. 8:
Height classes of *Senna reticulata* trees in stands of 2 and 6 years age. n = 1134 trees in plots of 2 years, n = 196 trees in plots of 6 years.

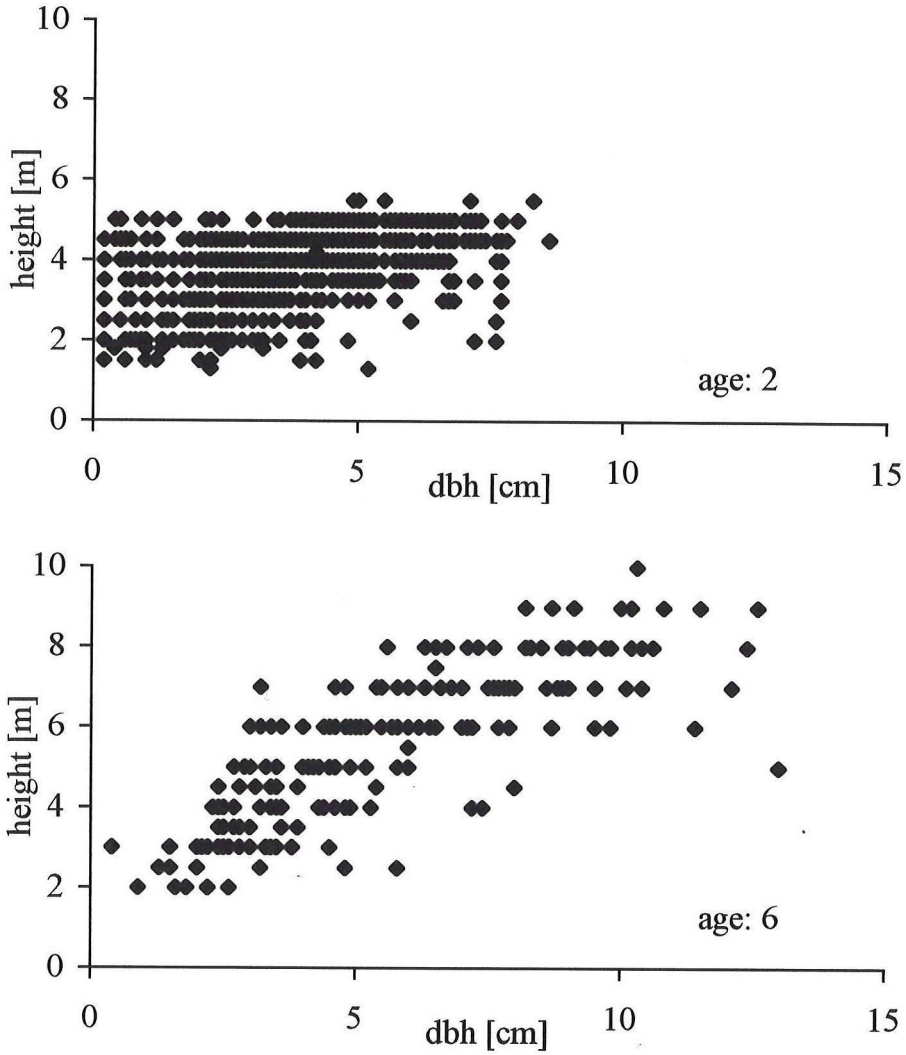

Fig. 9:
Height plotted against dbh of *Senna reticulata* in stands of different age (*Senna reticulata* trees in plots of 2 years age n = 338; plots of six years age n = 195).